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Abstract

What are the positive and normative implications of eliminating bankruptcy protection for indebted individuals? Without bankruptcy protection, creditors can collect on defaulted debt to the extent permitted by wage garnishment laws. The elimination lowers the default premium on unsecured debt and permits low-net-worth individuals suffering bad earnings shocks to smooth consumption by borrowing. There is a large increase in consumer debt financed essentially by super-wealthy individuals, a modest drop in capital per worker, and a higher frequency of consumer default. Average welfare rises by 1 percent of consumption in perpetuity, with about 90 percent of households favoring the change.

Keywords: Default, Bankruptcy, Garnishment, Unsecured Consumer Credit
JEL Codes: C68, E21, E22, E61, K35

1 Introduction

Unlike most other industrialized countries, default on consumer debt is a very common occurrence in the United States. Fundamentally, this feature of the US consumer credit market derives from the institution of personal bankruptcy: An indebted individual has the legal right to petition a bankruptcy court to have his or her financial obligations *discharged*, following which creditors must

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cease all efforts to collect on the debt. The option to declare bankruptcy limits how vigorously creditors can pursue delinquent debtors and, knowing this, debtors choose to default on their debt more readily. Since the start of the crisis-induced downturn in September 2008, the outstanding stock of revolving consumer debt has declined by more than 15 percent. It declined, in part, because debtors stopped making payments on their obligations and, as required by regulation and law, the defaulted debt was charged off and removed from the balance sheets of creditor banks.

Given this recent experience, it is tempting to ask whether policies designed to discourage consumer bankruptcy are desirable. The answer is not obvious. On the one hand, discouraging bankruptcy makes it harder for over-extended households to escape the consequences of bad luck. On the other hand, by making default less likely it makes credit cheaper and permits better consumption-smoothing. Exactly how much cheaper, though, depends on the constraints imposed on creditors by *garnishment laws*. These laws allow households some measure of protection against creditors and serve somewhat the same function as the "safety valve" of personal bankruptcy. The goal of this paper is to answer the following specific question using quantitative theoretic methods: What are the positive and normative implications of eliminating the personal bankruptcy option and letting current garnishment laws be the sole operative law dealing with consumer default?

The implications of eliminating the bankruptcy option, or discharge, have been studied by previous authors in a quantitative setting. However, these studies uniformly equate the "no-bankruptcy" world to an environment with an infinite cost of defaulting on consumer debt.[1] This is problematic for two reasons. First, there is ample historical evidence to suggest that there will be default on consumer debt even in the absence of bankruptcy protection. Indeed, it was the plight of delinquent debtors caught in the grip of unrelenting creditors that provided the impetus and motivation for discharge.[2] Second, the assumption has unpalatable consequences for the theory: It implies that the consumer can borrow, at the risk-free rate, as much as the present discounted value of the stream of the lowest earnings realization possible. Even for very low earnings realizations this bound (the so-called "natural borrowing limit") can be quite large relative to average income. Unrestricted ability to borrow such large sums at the risk-free rate is patently unrealistic and distorts the assessment of the welfare gain from eliminating bankruptcy protection.

In contrast, the"no-bankruptcy" world in this paper features a realistic alternative to the bankruptcy option, one that is based on garnishment laws actually in existence. The elimination of bankruptcy protection does not eliminate consumer default – individuals in dire straits can default and repay their debt gradually over time by subjecting themselves to wage garnishment. The possibility of default, and subsequent slow repayment on defaulted debt, makes consumer loans expensive even in the absence of bankruptcy protection. Thus the approach taken in this paper features a more plausible counterfactual loan supply schedule and is consistent with the historical

[1]Examples are Athreya (2002, 2008), Li and Sarte (2006), Chatterjee, Corbae, Nakajima and Ríos-Rull (2007) and Athreya, Tam and Young (2009).

[2]See, for instance, the discussion in Coleman (1999) and Warren (1935).

experience of consumer default during the pre-discharge era.

Elimination of bankruptcy protection results in only moderate changes in factor prices and a 1 percent increase in average welfare. However, it results in a two orders of magnitude increase in unsecured debt. This large increase in debt results from the fact that the added commitment to honor debt contracts lowers interest rates and encourages low-net-worth individuals suffering bad earnings shocks to borrow more in order to smooth consumption. The additional borrowing results in a small rise in the risk-free interest rate – and a correspondingly small decline in real wages – because the very wealthy have a high interest elasticity of savings. Since low-net-worth individuals borrow from high-net-worth individuals, the expansion in debt results in a correspondingly large increase in wealth inequality. The large increase in debt is accompanied by an increase in the frequency of consumer default. Despite lower wages and higher default rates, the majority of individuals prefer the "no-bankruptcy" world: the wealthy benefit from the higher risk-free interest rate and the poor from a decrease in borrowing costs.

Although delinquent debtors are permitted to lower their labor supply in response to the "garnishment tax," this channel is essentially inoperative in our model. There are two reasons for this: First, the elasticity of labor supply is chosen to produce a factor of 2 difference in the hours worked between high and low efficiency workers. Since these workers earn very different wages, the implied labor supply elasticity – consistent with microeconomic studies – is quite low.[3] Second, when people go into garnishment they often earn less than the threshold above which garnishment is operative, so their labor supply choice is not distorted. Thus, the findings reported in this paper do not support the notion that bankruptcy provides superior labor supply incentives.[4]

The prediction that elimination of bankruptcy protection will result in a large increase in consumer debt (and the associated large increase in wealth inequality) seems at variance with the experience of continental European countries. These countries, which historically have not permitted discharge of debt, do not display the high wealth inequality predicted by our garnishment-only (i.e., "no-bankruptcy") model. On the other hand, European countries display much less idiosyncratic earnings risk than the US, which could also account for their less extreme wealth distributions. Taking Sweden (which did not permit discharge until 2005) as a test case, we show that when we simulate our garnishment-only US model with the Swedish earnings process, the model generates a wealth distribution that is close to Sweden's actual wealth distribution. Thus less risky earnings processes may explain why these countries do not display the extreme wealth distribution predicted by our model despite having not permitted discharge historically.

A policy change as dramatic as elimination of bankruptcy protection compels a re-thinking of garnishment law as well. With this in mind, the paper also investigates the optimal garnishment regime in the absence of discharge. It finds that welfare is higher if elimination of discharge is

[3]Increasing the difference in hours worked to a factor of 4 leads to essentially the same results.

[4]This finding is in line with the results reported in Li and Han (2007). Chen (2010) argues that the labor supply effect of bankruptcy is positive but small because of off-setting wealth and substitution effects.

also accompanied by less liberal (from the viewpoint of debtors) garnishment laws. How much less depends on the details of the earnings process: The possibility of a low probability "disaster state" (in which earnings are very low) pushes policy in the direction of a more liberal garnishment law. Still, results suggest that current garnishment laws are too liberal: Welfare would be higher if less income is protected from garnishment.

Among existing quantitative studies, two come closest to the spirit of this study. The first is Livshits, MacGee and Tertilt's (2007) comparison of the discharge option (or "Fresh Start") with something akin to garnishment (which they label the "European System").[5] But there are some important differences between their study and this one. First, our goal is to compare a regime in which both bankruptcy and garnishment are active in equilibrium (as it is in reality) with a regime in which only garnishment can be active. Second, we model the production side of the economy, whereas Livshits, MacGee and Tertilt work with an endowment economy. The first difference is important because the co-existence of bankruptcy and garnishment bounds the costs of garnishment (these costs must be much lower than those for bankruptcy; otherwise, individuals will always opt to discharge their debts) which, in turn, has consequences for the deadweight costs of default in the garnishment-only economy. The second difference is important because strong general equilibrium effects can potentially emerge from elimination of bankruptcy protection.[6]

Second is Li and Sarte (2006), who examine the welfare effects of means-testing for obtaining a discharge (so-called Chapter 7 filing), when the alternative to discharge is partial debt repayment (so-called Chapter 13 filing).[7] If the qualifications for a discharge are made so stringent as to leave Chapter 13 as the only default option, the institutional arrangement may seem to resemble one in which defaulters can either repay their debts or subject themselves to "garnishment." But this resemblance is more apparent than real. In practice (as well in the theory presented in Li and Sarte, 2006), a Chapter 13 filing will involve substantial forgiveness of debt. Thus, permitting Chapter 13 filings *only* is not the same as eliminating discharge altogether. Li and Sarte do consider the case where bankruptcy protection is eliminated completely (so neither Chapter 7 or 13 filings are permitted) but they do not consider the possibility that debtors may still default and repay their debts gradually in accordance with the debtor protection offered under garnishment laws.

There is also an important substantive difference in the environment analyzed in this paper and the one in Li and Sarte (2006). The latter assume that people borrow (subject to an exogenously

[5] In their "European System," an individual cannot discharge his debt, so default leads to some portion of his future wage earnings being taken in satisfaction of the creditors' claim. In the working paper version of the paper, Livshits, McGee, and Tertilt (2003), the authors also considered the case where the garnishment process allowed households to work less and featured a constant exemption level.

[6] This point was stressed in Li and Sarte (2006), who showed that taking into account general equilibrium effects can overturn welfare results obtained in partial equilibrium settings.

[7] "Chapter choice" is a decision about protecting current assets versus future earnings. In a Chapter 7 filing, the individual relinquishes all his non-exempt assets but in return gets to keep his future wage earnings; in a Chapter 13 filing, the individual gets to keep his non-exempt assets but agrees to repay his outstanding debts over time but only up to the value of the non-exempt assets that would have been relinquished under a Chapter 7 filing.

given borrowing limit) at an undifferentiated interest rate that fetches zero profits when returns are averaged across all borrowers. Since the interest rate charged on loans is independent of the size of the loan, large borrowers (who are worse risks) are subsidized by small borrowers.[8] In contrast, the approach followed in this paper eschews any form of cross-subsidization across borrowers: Every loan makes zero profits, in expectation. Since default risk varies with individual characteristics (in particular, earnings) as well as the amount borrowed, individuals borrow at differentiated interest rates. This is consistent with the evidence: For the US, Edelberg (2006) has shown that interest rates on unsecured consumer credit vary positively with perceived default risk - i.e., pricing of consumer loans is risk-based.[9] Because bigger loans require higher interest rates, how much individuals can borrow to smooth consumption is limited. Consequently, the elimination of discharge – and the resulting shift out in individual loan supply schedules – has a more dramatic effect on an individual's capacity to borrow. This expansion in credit, combined with the riskiness of the US earnings process, underlies both the predicted welfare gain as well as the predicted increase in wealth inequality.[10]

In related work, Athreya (2008) presents a careful study of the implications of eliminating bankruptcy protection in a partial equilibrium life-cycle setting with earnings risk. Elimination is taken to mean that default becomes infinitely costly, which, in turn, means that the maximum level of borrowing that can be supported in the no-bankruptcy equilibrium is determined by the natural borrowing limit. This introduces a tight link between "default policy" and "social insurance provision," which the paper explores. In Athreya, Tam and Young (2009), the focus is on understanding (again, in a partial equilibrium context) the merits of harsh default penalties (in effect, making the cost of default infinite) versus keeping penalties low but providing loan guarantees to lenders so as to lower the price of credit to households.

[8] Conceptually, this formulation is problematic for the following reason: A lender can come in to serve small borrowers at a slightly lower interest rate and make positive profits. Thus, this formulation implicitly assumes restriction on entry.

[9] In practice, the interest rate paid by a borrower is negatively related to the individual's credit score – which is an index of the probability of repayment of a loan. Credit scores are lower for observably higher risk individuals and they tend to fall with increased borrowing. Thus higher risk individuals pay higher interest rates and interest rates paid tend to rise with the amount of outstanding debt. Chatterjee, Corbae and Ríos-Rull (2011) provide more details on the relationship between repayment behavior, borrowing and the evolution of credit scores.

[10] In the case where Li and Sarte (2006) allow only Chapter 13 filings, the increase in the debt-to-income ratio is about 4 percent and the increase in steady state welfare -1 percent (Table 4, p. 628). It is worth noting that their calibration is different in 3 important respects. First, their debt-to-income ratio is 6 percent, much higher than the 0.09 percent used in this study. In this paper, only negative net-worth individuals are viewed as borrowing unsecured so the debt-to-income ratio is much lower. Second, the efficiency process used in Li and Sarte has an unconditional standard deviation of 0.56, while the process used in this paper has an unconditional standard deviation of 7.92 (mean of both processes is 1). Third, Li and Sarte allow for proportional transactions costs on loans, while transactions costs are ignored in this study.

2 The Model Economy

This section discusses the model economy. For a more extensive model description, the reader is referred to the appendix.

2.1 Preferences and Technology

At any given time, there is a unit mass of people in the economy. Each person has a probability of survival given by $\rho \in (0,1)$ so that a fraction $1-\rho$ of the population dies each period and is replaced by newborns.

Each person has a unit of time endowment. People differ in terms of the productive efficiency of their time endowment, which varies stochastically over time. These efficiencies are denoted by e. In any period, an individual's e is drawn from a discrete probability distribution with compact support $E \subset R^{++}$ and probability mass function $\phi_s(e)$.[11] Here, s is a finite-state Markov chain taking values in a set S with transition probabilities $\pi_{s,s'}$. Draws from this process, as well as from $\phi_s(e)$, are independent across people. Thus, the efficiency process has a persistent component controlled by s and a transitory component controlled by ϕ_s. A person's anticipated lifetime utility from a sequence $\{c_t, n_t, e_t\}$ of consumption, effort and efficiency levels is given by

$$\sum\nolimits_{t=0}^{\infty}(\beta\rho)^t u(c_t, n_t, e_t) \tag{1}$$

where β is the discount factor, ρ is the probability of survival and the momentary utility function $u(c,n,e) : [0,\infty) \times [0,1] \times E \to R$ is strictly increasing and concave in c, strictly decreasing and convex in n, and differentiable in the first two arguments. For technical reasons, the efficiency level is allowed to affect period utility.

There is an aggregate production function $F(K,N) : R_+ \times R_+ \to R_+$, which gives the total quantity of the single good produced in this economy as a function of the aggregate capital stock K and aggregate efficiency units of labor N. We assume that F is CRS, differentiable, increasing and displays diminishing marginal products with respect to each input. The capital stock depreciates at the rate $\delta \in (0,1)$.

2.2 Market Arrangement

In each period, there is a market for efficiency units of labor where people and the representative firm in charge of the (aggregate) production technology transact in labor services: people can sell

[11] In Chatterjee et al. (2007), these probability distributions were assumed to be continuous, not discrete (continuous e is necessary to prove the existence of a competitive equilibrium). Provided the number of grid points on e is large, reasonably accurate solutions to equilibrium prices can be found. See Chatterjee and Eyigungor (2010) for discussion of the computational challenges involved in computing debt/default models of this type and their Appendix B for a comparison of the numerical accuracy of the solution when e is taken to be discrete vs continuous.

any portion of their efficiency endowments to the firm at the wage w_t per efficiency unit, where the wage is expressed in terms of the period-t consumption good.

There is a market for the services of physical capital. The representative firm can rent physical capital from an intermediary sector at the rate of r_t units of consumption good per unit of capital.

Most crucially, there is a market in which people can borrow and lend. When a person borrows, the option to default implies that the interest rate at which he borrows will depend on his likelihood of default. The latter, in turn, will depend on all observable factors that potentially influence that likelihood. In the context of this model, these factors are (i) the size of the liability (or promise), (ii) the person's current efficiency status and (iii) all current and future factor prices. It is notationally convenient to denote assets by positive numbers and liabilities by negative numbers. We use $\mathbf{p}$ to denote the sequence of current and future factor prices $\{w_j, r_j\}_{j=0}^{j=\infty}$. Then, the unit price of a promise to deliver y (if $y < 0$) units of the consumption good next period by a person with current persistent state s is $q(y, s, \mathbf{p}) > 0$.[12] By making this promise, the person receives $q(y, s, \mathbf{p})(-y)$ units of the consumption good in the current period. If $y \geq 0$, the person obtains a promise to receive y next period and gives up $\bar{q}(\mathbf{p})y$ in the current period. Thus, people borrow at interest rates that vary with the loan size but lend at an interest rate that is independent of the amount lent and the person's efficiency level. These prices depend on the current and future trajectory of factor prices because our analysis allows for transition dynamics. In addition to the market for new loans and deposits, there is also a market where intermediaries may trade debt that is in default. The market price of an unpaid obligation of the amount $y < 0$ belonging to an individual with current persistent efficiency level s is denoted $x(y, s, \mathbf{p})$.

It is assumed that the intermediary sector is the counterparty in all intertemporal trades entered into by people. One implication of this assumption is that if a person dies, his assets or liabilities are absorbed by the intermediary sector.

2.3 Garnishment, Bankruptcy, Collecting and Reporting Laws

A brief description of US wage garnishment laws is now provided. If a debtor fails to repay a debt, creditors have the legal right to seize the debtor's property and earnings in satisfaction of their claims. The purpose of wage garnishment laws is to provide some measure of debtor protection against creditor rights. Federal law stipulates that 75 percent of a debtor's disposable earnings are outside the reach of creditors, with many states choosing to protect even more.[13] To garnish a person's wages, a creditor must obtain a court order and this order is granted for a limited time only. Upon expiration of the order, a new order must be obtained if the garnishment is to continue. Because garnishment is costly, creditors have a strong incentive to pass these costs

[12] The price depends only on the persistent component of efficiency because this is the component that helps predict the future efficiency level e' and persistent state s'. In particular, current e does not affect the price because it is a purely transitory draw that does not predict future earnings.

[13] See Lefgren and McIntyre (2009), Table 2.

on to the debtor. Federal law (the Fair Debt Collection Practices Act) stipulates that creditors cannot add additional charges (such as fees and interest charges) to the original obligation unless such additions are permitted explicitly by the contract or by the state (if the contract is silent on it). State practice varies quite a bit in this regard, with some states permitting additional fees and interest charges on the unpaid debt. However, courts generally take a dim view of creditors' attempts to recover more than reasonable collection costs through this channel. Lastly, a federal statute of limitations on unpaid debt exists: if a debt has not been paid in over 10 years, the creditor loses the right to garnish wages (or seize property) in satisfaction of the claim.

This institutional setup is mapped into our model in the following way. First, it is assumed that no additional fees or interest charges can be assessed on unpaid debt. Second, there is assumed to be no statute of limitations on unpaid debt and no transactions costs of enforcing wage garnishment. Consequently, if a delinquent debtor chooses not to file for bankruptcy, garnishment continues for as long as there is any unpaid obligation. Third, as long as there is any unpaid obligation, the debtor cannot accumulate assets and must pay some legally determined fraction of disposable income to the creditor. In the model, the garnishment formula is modeled as the assumption that the delinquent debtor must pay at least $\min\{\max\{0, \gamma(wen - c_{\min})\}, -a\}$ toward reducing his obligation, where γ is the fraction of disposable income that can be garnished, wen is current period earnings, $-a$ is the size of the unpaid obligation in the current period, and $c_{\min}$ is "reasonable living expenses" as determined by law. Importantly, the choice of n is left to the delinquent debtor and there is no compulsion to earn above $c_{\min}$. Lastly, it is assumed that delinquency and garnishment have pecuniary costs to the debtor, which are modeled as a consumption loss of proportion χ_g of earnings. These costs are paid every period the debtor is under garnishment and, once the garnishment ends, for as long as lenders know that the person was garnished sometime in the past (more on this below).

Turning attention to the modeling of bankruptcy, the following assumptions are made. First, a debtor has the right to have his unpaid obligations discharged. Second, there are no transactions costs of filing for bankruptcy. Third, a debtor filing for bankruptcy must forfeit all his assets to satisfaction of the claim. Fourth, the process of obtaining discharge consumes the entire period so that in the period of bankruptcy, the debtor can neither accumulate assets nor borrow. Lastly, it is assumed that bankruptcy imposes pecuniary costs that result in a loss of consumption equal to a proportion χ_b of earnings and that these are paid for as long as lenders know a person declared bankruptcy in the past.

In addition to garnishment and bankruptcy laws, the Fair Credit Reporting Act stipulates how long negative information, such as late payments, bankruptcies, garnishments, and tax liens, may stay on a person's credit report. By law, bankruptcy information can stay on a credit report for ten years. Garnishments can stay on the report for twelve years from the date of entry or for seven years from the date they were satisfied. This aspect of US law is relevant for our study because negative information in a person's credit report appears to impair the person's access to credit.[14]

In the model, the following assumptions are made regarding the consequence and duration of negative credit information. First, a person with a record of a past bankruptcy or a past garnishment cannot borrow. Second, the record of a past bankruptcy is removed from a person's credit history with probability λ_b. Third, a record of garnishment always appears as long as the individual is under garnishment. Fourth, if a person under garnishment files for bankruptcy, his record of garnishment is replaced by a record of bankruptcy. Finally, a record of past garnishment is removed with probability λ_g.

2.4 Equilibrium

The preceding environment maps into decision problems for individuals in the following way. Surviving individuals enter into a period with either assets or debt and with either a clean credit record or an impaired one. A credit record is impaired if it has either a bankruptcy or garnishment "flag," i.e., a record of past bankruptcy or garnishment that has not been removed. An individual with debt and a clean credit record gets to decide if he wants to default on the debt and, conditional on defaulting, whether to file for bankruptcy or subject himself to wage garnishment. If the person chooses not to default, he decides how much to borrow or save in the current period. An individual with debt and a garnishment flag gets to choose whether to continue on in garnishment or to declare bankruptcy. If the person declares bankruptcy, then he cannot borrow or save in the current period and his garnishment flag is turned into a bankruptcy flag; if he continues on in garnishment, he cannot borrow but he can accumulate assets if he pays off all his unpaid obligations. An individual who enters the period without debt does not have a default decision to make. If his credit record is clean, he chooses how much to borrow or save; if his credit record is impaired, he cannot borrow but he can save. All individuals, no matter what their circumstances, get to choose how hard to work.

The (representative) competitive intermediary's decision problem is static: it simply decides how much of each type of loan to make at the going price of each type of loan. By the law of large numbers, the intermediary's aggregate return on its loan portfolio is constant. Thus, it operates like a risk-neutral lender with respect to each individual loan. In equilibrium, the price of any individual loan adjusts to generate exactly zero net return. Thus, the intermediary is indifferent about making any particular loan: it simply writes loans that consumers want. A loan that defaults into bankruptcy pays nothing; a loan that defaults into garnishment may pay something and, in addition, becomes a defaulted debt that can be traded in the market at some price. If there is no default on the loan, the loan pays back what was promised.

[14] Musto (2004) provides compelling evidence in favor of this assumption. See Chatterjee, Corbae and Ríos-Rull (2011) for the theoretical foundation for this finding.

3 Calibration

This section discusses the calibration of the model economy.

3.1 Functional Forms

For $u(\cdot)$ it is assumed that

$$u(c,n,e) = (1-\sigma)^{-1}\left(c - \zeta\frac{n^{1+\xi}}{1+\xi} + A(e)\right)^{(1-\sigma)}, \text{ with } \sigma > 0, \zeta > 0, \xi > 0. \tag{2}$$

Thus, we adopt the Greenwood, Hercowitz and Huffman (1988) specification for preferences, modified slightly as in Mehlkopf (2010), to allow for a state dependent constant term $A(e)$. There are two advantages to this specification. First, the level of consumption c does not affect the MRS between consumption and effort, which is simply given by ζn^{ξ}. Second, for any feasible c, the requirement that $c - \zeta n^{1+\xi}/(1+\xi) + A(e) \geq 0$ – which is needed for current utility to be well-defined – can be effectively reduced to the requirement that $c \geq 0$ by an appropriate choice of $A(e)$. By the first property, the unconstrained choice of n for a person in good standing is given by $\bar{n}(e;\mathbf{p}) = (ew(\mathbf{p})/\zeta)^{1/\xi}$. In what follows, we set $A(e)$ to be equal to $\zeta(\bar{n}(e;\bar{\mathbf{p}}))^{1+\xi}/(1+\xi)$ where $\bar{\mathbf{p}}$ denotes the sequence of (constant) factor prices associated with the targeted capital output ratio. In the steady state, where w is constant over time, this term will vary with e only and will generally offset the $-\zeta(n(a,e,h,s;\mathbf{p}))^{1+\xi}/(1+\xi)$ term. Thus, the requirement that $c - \zeta n^{1+\xi}/(1+\xi) + A(e) \geq 0$ will effectively become the requirement that $c \geq 0$. Furthermore, when the offset is operative, utility is simply given by $c^{1-\sigma}/(1-\sigma)$.

It is assumed that for the vast majority of the population, the efficiency level e follows the process

$$\ln(e_t) = \omega + z_t + \nu_t \text{ with } z_t = \psi z_{t-1} + \varepsilon_t, \psi \in (0,1), t \geq 1 \tag{3}$$

where ω is drawn at birth from a Normal distribution with mean 0 and variance σ_ω^2, ν_t and ε_t are drawn from Normal distributions with mean 0 and variance σ_ν^2 and σ_ε^2, and z_0 is drawn from the invariant distribution of the AR1 process. Thus the efficiency process (and consequently the earnings process) has three components: a permanent component that is determined at the time the person enters the economy, a persistent component that follows an AR1 process and a purely transitory component. However, it is assumed that any individual, regardless of his or her ω, z_t, and ν_t, can draw an extremely high (relative to mean) efficiency level, denoted $E_{\max}$, with a (small) probability π_0. From this "super-rich" state, he returns with probability π_1 to an efficiency level drawn according to the invariant distribution of ω, z_t, and ν_t. This super-rich state is added to generate the highly skewed wealth inequality seen in the US. The combined efficiency process can be mapped back to the model's efficiency process via a suitable choice of the set S and the distributions

ϕ_s.

Lastly, it is assumed that the aggregate production function is given by $K^{\alpha}N^{1-\alpha}$.

3.2 Data Targets and Parameter Values

With these functional forms, aside from $A(e)$, there are twenty parameter values to fix. These are four preference parameters (β, σ, ζ, ξ); one demographic parameter (ρ); four technology parameters ($\alpha, \delta, \chi_g, \chi_b$); four legal system parameters ($\lambda_g, \lambda_b, c_{\min}, \gamma$); and seven efficiency parameters (σ_{ω}^2,σ_{ν}^2,σ_{ε}^2,ψ,π_0,π_1,$E_{\max}$).

Values for ($\sigma_{\omega}^2, \sigma_{\nu}^2, \sigma_{\varepsilon}^2, \psi$) are chosen to match the wage process estimates in Floden and Linde (2001) for the US. Wages as measured in Floden and Linde correspond to $w(\mathbf{p})e$ in our model. Thus, in the steady state, their estimated wage process can be used to calibrate the efficiency process and this fixes ($\sigma_{\omega}^2, \sigma_{\nu}^2, \sigma_{\varepsilon}^2, \psi$) to $(0.1175, 0.0421, 0.0426, 0.9136)$. The parameters π_0 and π_1 are taken from Chatterjee et al. (Table III, p. 1550), who also incorporate this state to generate the observed US wealth inequality. This fixes (π_0, π_1)=$(0.0001, 0.020)$.[15] The mean of the augmented efficiency process is normalized to 1, with $E_{\max}$ equal to 731.7. The value of $E_{\max}$ was set to essentially match the capital output ratio.[16] By way of comparison, if mean household income of \$60,000 is equated to the mean earnings in the model, $E_{\max}$ results in income of \$71 million.

The capital share of income α is set to 0.36 and the depreciation rate of capital δ is set to 0.10, values that are standard in quantitative studies. The value of ρ was set to .975 so that the expected lifetime is 40 years. The value of σ was set to 2. The value of ξ was constrained by requiring that the highest paid person work twice as long as the lowest paid person. Using the expression for unconstrained labor choice, this restriction requires that $[E_{\max}/E_{\min}] = 2^{\xi}$ where $E_{\min}$ is the lowest value of the discretized efficiency process. This fixes ξ to 11.8, which implies a labor supply elasticity of 0.09, consistent with the generally low values of elasticities found in micro studies.[17]

The garnishment rate γ was chosen to be 0.25, which is the federal limit.[18] IRS Financial Collection Standards for allowable living expenses were used to estimate the "reasonable cost of living," $c_{\min}$. This took into account the allowable costs of housing, utilities, food, personal care and services, and miscellaneous expenses for households of different sizes. The distribution of

[15]Note π_0 is calculated from Chatterjee et al.'s parameters as the probability of moving to the super-rich state conditional on being either white-collar or blue-collar.

[16]Although the capital output ratio is affected by other parameters, $E_{\max}$ largely controls the amount of wealth held by the super-rich and thus has a disproportionately strong effect on the capital output ratio.

[17]Domeij and Floden (2006) have noted that borrowing constraints could downwardly bias the estimate of labor supply elasticity for certain specifications of utility functions. Our GHH specification does not suffer from this bias because labor supply is independent of consumption and therefore wealth.

[18]Lefgren and McIntyre (2009) (Table 2, pp. 376-77) report that 23 US states adhere to the federal guideline on the fraction of disposable income that must be protected from garnishment (75 percent). Of the remaining states, 15 allow more than 75 percent to be protected from garnishment and the rest have an absolute minimum level of weekly earnings that are protected from garnishment.

household size in the US was then used to arrive at an average estimate for reasonable living expenses. Normalizing this estimate by average household income gives a value of 0.6103. The value of $c_{\min}$ was set such that the ratio of $c_{\min}$ to average earnings in the model is 0.6103. Thus, roughly speaking, if a person's earnings are less than 60 percent of mean income, he will not be obligated to make any payments on his defaulted debt. The values of λ_b and λ_g were set to 0.1 and .143 respectively, so that a record of bankruptcy remains on a credit history on average for 10 years and a record of garnishment on average for 7 years.

This leaves four parameters, ζ, β, χ_b and χ_g, which are set so as to make model moments come close to relevant data moments.[19] These data moments are (i) the fraction of hours worked, (ii) the fraction of people in debt, (iii) the fraction of people filing for bankruptcy, (iv) the debt-to-output ratio, and (v) the aggregate collection rate on defaulted debt. The last statistic is simply the ratio of the amount paid each period on delinquent debt by people under garnishment to the total debt defaulted upon each period. Data on the first four statistics are easily available. Data on the fifth statistic (the aggregate collections ratio) are not. The target of 20 percent is an estimate by one researcher familiar with the collections industry.[20]

Table 1 gives the values of the parameters and the data targets that determine these parameters (for the four parameters that are jointly determined, the assignment is to the data target that mostly determines that parameter). Since we are calibrating to the wage process from the PSID, the earning inequality is not as high as in the data. This discrepancy presumably reflects the fact that the PSID does not provide accurate information on people with very high incomes. Although the PSID earnings process is augmented with the super-rich state, the fraction of people earning very high incomes is still very low so that the earnings Gini is well below what is observed in the US data. But the addition of the super-rich state does help bring the model Gini on wealth close to the data. The people who become super-rich have both the opportunity (very high incomes) and the incentive (the state is very transitory) to accumulate large amounts of wealth. The model is able to match the capital output ratio and the aggregate collections ratio fairly well but cannot match the debt statistics exactly. The filing rate and the debt-to-output ratio are too low relative

[19] The model is solved using a collection of mostly standard techniques. The persistent and permanent components of the efficiency process are discretized using the recent Rouwenhorst method introduced by Kopecky and Suen (2010). We use 3 permanent states and 5 persistent states. Conditional on having a permanent and persistent state, the probability of having a particular level of efficiency is calculated using Tauchen's (1986) method. The levels of efficiency (but not their probabilites) are chosen by discretizing the unconditional distribution using the Rouwenhorst method. We use 5 levels of efficiency (for a total of 75 states). The additional super-rich and/or super-poor state is added as discussed in the main text. The household problem is solved using a grid search accelerated with policy function iteration.

[20] We thank Robert Hunt of the Federal Reserve Bank of Philadelphia's Payment Cards Center for this estimate. Hunt reports that according to ACA International, the average gross recovery rate on defaulted revolving debt in 2008 was 22 percent (the sample size is about 50 collection firms). From this amount the collection firm takes its cut (about 30 percent) and returns the remainder to the company that placed the debt for collection. So the net recovery rate to the owner of the debt is about 15 percent. Information from a large credit card lender indicates that the gross recovery rate is typically 20 percent and the net recovery rate is typically 12-14 percent. Our model abstracts from transactions costs, so we target the gross figure of 20 percent in our calibration.

to the data and the fraction of population in debt too high. To get more debt into the model, the interest rates on debt must fall but that increases the fraction in debt further above target and tends to push the filing rate further below target.[21] The existing configuration is about the best the model can do. The average interest rate paid by borrowers is 22 percent and the debt-weighted average is 35 percent.[22]

[Insert Table 1 here]

A novel feature of our model is the choice between bankruptcy and garnishment. In the bottom section of Table 1 some statistics relevant to this choice are reported. In equilibrium, both options are active, with the fraction defaulting and going into garnishment being 0.42 percent each period (as compared to 0.29 percent for bankruptcy). The total stock of people with impaired credit (with either a bankruptcy or a garnishment "flag" in their credit history) is 5.2 percent, with a majority having a garnishment flag.[23] Although the fraction filing for bankruptcy is only 34 percent of the total number of people defaulting, the fraction of debt that is written off in bankruptcy is 72 percent of total defaulted debt. This is intuitive: Bankruptcy is not the optimal choice when the individual wishes to default on a low level of debt because both the flow cost and the duration of punishment are higher for bankruptcy than for garnishment. Consistent with this logic, the average income of debtors filing under bankruptcy is higher than the average income of debtors defaulting into garnishment (0.16 vs 0.13). Because the debt that goes into garnishment is relatively small, garnishment generally does not last long: On average a person is under garnishment for 4 years. Most garnishments end in full repayment of debt, with only 1.2 percent of debtors being garnished moving into bankruptcy each period.[24] The population in debt and being garnished is 1.67 percent. In the data, this number is between 1.5 and 1.7 percent, which is a remarkably good fit.[25] Finally, the model predicts a much higher charge-off rate than what is observed in the data. In the data, the average gross charge-off rate between 1984 and 2007 is 4.81 percent. The comparable statistic

[21]The difficulty in matching the debt-to-income ratio, the filing rate and percentage in debt seems to be common to this class of models (see, for instance, Athreya, Tam and Young, 2009, and Chatterjee et al., 2007).

[22]These numbers seem high relative to reported interest rates. However, lenders often disguise interest charges as fees of various sorts. For instance, if a borrower is paying 18 percent interest on a credit balance of $500 and is charged late fees of $35 twice, the effective annual interest rate is close to 32 percent.

[23]Since garnishment information appears in people's credit history for some length of time, it should be possible to determine what fraction of people are carrying a garnishment flag. Unfortunately, given the aggregated form in which credit bureau data are made available to researchers, it is not possible to determine this fraction.

[24]The probability of filing increases over time for people in garnishment: If a person under garnishment does not exit garnishment, it is because his circumstances have either remained unchanged or deteriorated further. Further deterioration in earnings may trigger a bankruptcy filing.

[25]The figures are from PSID for 1997, 2002 and 2007. In these years, the survey asked (with minor variations) the following question: Have you had your wages attached or garnished by a creditor in the last 12 months? The percent is the number of respondents who answered yes to the question. It is possible that respondents may have answered no to this question if they made payments to creditors on the threat of garnishment, rather than actual garnishment. To the extent this is true, these figures underestimate the fraction of people under garnishment each period in the sense meant in the model. Also, the phrasing of the question seems to refer to any type of garnishment including those arising from back taxes, child support payments and other judgments. Since non-dischargeable debt is not considered in this paper, these figures are upper bounds on the model-relevant fraction of people being garnished.

in the model is 19.23 percent. This deviation is to be expected given the fact that we have too little debt in the model but the filing rate is about right.

Lefgren and McIntyre (2009) empirically examine the determinants of the frequency of Chapter 7 bankruptcy filings across US states. Among other findings, they report that states that mandate a higher threshold and protect a larger fraction of earnings above the threshold (restricted garnishment states) experience fewer Chapter 7 filings (Table 3, p. 381). This prediction is checked against the model by confronting two small (more precisely, measure zero) subsets of the model population with alternative garnishment laws: a less-restricted garnishment law in which $c_{\min}$ is set to 0.1 times average earnings and $\gamma = 0.25$ (no state can have γ higher than 0.25) and a more-restricted law in which $c_{\min}$ is set to 0.61 times average earnings and $\gamma = 0.10$. The long-run filing frequency is 0.25 for the less restricted garnishment law and 0.22 for the more restricted law. Correspondingly, the frequency of garnishment is 0.13 in the former and 0.51 in the latter. Thus, filing frequencies move in the direction consistent with the evidence, although the movement appears to be more muted in the model than in the data.[26]

4 Eliminating Bankruptcy Protection

This section reports how prices, allocations and welfare are affected if bankruptcy protection (the right to the discharge of debt) is eliminated. Indebted households may still default but creditors have the right to collect on their claims to the extent permitted by wage garnishment laws.

4.1 Allocations and Prices

Table 2 compares the baseline steady state with the garnishment-only steady state. In the garnishment economy, all parameters that are common between the baseline and garnishment economies are set to the values determined for the bankruptcy economy.

[Insert Table 2 here]

Comparison reveals some similarities and also some very striking differences. First, the average labor supply in the two steady states are basically the same – actually, aggregate labor supply is slightly lower in the garnishment economy. There are two reasons for this. First, labor supply is lower because wages are lower (as we will see below). Second, garnishment distorts effort choices downward because of the "tax" element. However, these effects do not amount to much because the elasticity of labor supply is low and an individual will leave himself the possibility of being

[26] This may be due to the fact that the model does not contain a third category of borrowers: the class of "informal bankrupts," who have stopped servicing their debts but are not pursued by their creditors because it is costly to do so. Movements in and out of this category could account for the more pronounced effects of differences in garnishment laws (Dawsey and Ausubel, 2004 and Dawsey, Hynes and Ausubel, 2004). Furthermore, state variation in Chapter 7 filing rates may also result from state differences in Chapter 7 homestead exemptions. This is the explanation put forward in Mitman (2011) in the context of a quantitative-theoretic model that distinguishes between housing and non-housing wealth; Li and White (2009) make a similar point in the context of regression analysis.

garnished only if it's not that distortive for him (either because the individual earns less than $c_{\min}$ or he can pay off the debt quickly). Because labor supply is not that much affected by the garnishment regime, the earnings Gini remains essentially the same.

The most striking difference between the two equilibria is in the debt measures. In the baseline economy the percentage in debt is a little under 5 percent, but in the garnishment economy it is a little under 30 percent – an increase of a factor of 6. Additionally, the debt-to-output ratio goes from 0.09 percent to around 22 percent. The proximate reason for this huge expansion in credit is a shift up of the $q(a, s; \mathbf{p})$ schedule, stemming from a decline in the probability of default.[27] The lower interest rates motivate people to borrow more and the expansion in debt continues until the default rate reaches roughly the same level as in the baseline economy. Importantly, the elimination of discharge does not reduce the default – in fact, it increases it.

Even though the default rate is only somewhat above the baseline economy, the fraction of people with impaired credit (i.e., in bad standing) is much higher. The reason is that the duration of garnishment lasts much longer now because when people default they do so on much larger levels of debt and it takes longer to repay those debts and exit garnishment.

The increase in consumer credit can be expected to crowd out fixed capital, and it does, but surprisingly little. The capital to output ratio declines from 3.08 to 2.97. The drop results in a slightly higher risk-free interest rate, which rises from 1.74 percent to 2.05 percent, a rise of about 30 basis points. The decrease in capital per worker results in a decline in wages of 1.67 percent. The decline in capital stock is muted because of the presence of the super-rich. These individuals have a very elastic supply of savings and expand their savings to accommodate the increased demand for consumer loans. If we eliminate the super-rich along with discharge, the capital output ratio falls to 2.71 and the (net) rental return on capital climbs to 3.29 percent. Thus, getting the baseline wealth distribution to match reality (which necessitated the addition of the super-rich state) has important implications for the counterfactual.

Finally, Table 2 shows that there is a massive increase in wealth inequality. This comes about because so many individuals become indebted. The top 5 percent of the population ends up holding 66 percent of total wealth in the garnishment-only economy compared with 56 percent in the baseline economy. The bottom quintile has negative net-worth amounting to 7 percent of total wealth.

Why exactly does the incentive to default change so drastically in the garnishment economy? There are two effects at work. One is the *stick effect*, which is that default is more costly to the individual, and the other is the *carrot effect*, which is that maintaining access to markets is

[27] Athreya (2008, Table 1 p. 762) reports what happens if *default* is eliminated, so individuals can borrow at the risk-free rate up to their natural borrowing limit. Although the calibration of his model is quite different from ours and he keeps the risk-free interest rate constant, it is interesting to compare his findings to ours. Athreya finds that if default is eliminated, the fraction of indebted households rises to almost 40 percent and the aggregate debt to output ratio rises to 39 percent. The latter increase is almost twice what we find in our paper. The difference in results highlights our contention that what exactly replaces the bankruptcy option matters for the outcome.

more beneficial. Figure 1 shows that both effects are at work. The mostly flat dashed line with circles shows for a typical efficiency level the value function of defaulting in the baseline economy, which is the maximum of declaring bankruptcy and entering garnishment. The flat region is where bankruptcy is the best option. The dashed line without circles is the value of defaulting in the garnishment-only economy. Observe that as the debt level rises, default in the garnishment-only economy becomes increasingly worse relative to the value of default in the baseline. This is the stick effect of garnishment: default under garnishment is simply not as beneficial to the individual as default under bankruptcy. The solid line with and the solid line without circles show the value function conditional on repaying debt in the baseline and garnishment-only economies respectively. Notice that the value of repaying debt in the garnishment-only economy lies considerably above the value of repaying debt in the baseline. This is the carrot effect of garnishment: by lowering the costs of borrowing, the garnishment-only economy increases the value of maintaining access to the credit market. The lens-shaped areas trapped between the solid and dashed lines is where households do not default. This area is much larger in the garnishment-only economy because of these two effects.

[Insert Figure 1 here]

The increased value of maintaining access to the credit market is apparent in the positioning of the price schedules in the baseline and the garnishment-only economies. Figure 2 shows the average loan price for the two economies for different levels of debt: credit is available under more generous terms in the garnishment-only economy than in the baseline economy. Competitive lenders are willing to extend loans on more generous terms because debtors do not default as much, and even when they do default, they pay their debts back in due course.

[Insert Figure 2 here]

Is the large increase in wealth inequality a credible implication of the lack of discharge? A case in point is Sweden, which until 2005 did not permit discharge of debt and, yet, Sweden does not have the wealth inequality predicted by our model. But Sweden's income process is different as well. Table 3 reports wealth distribution statistics if the US garnishment-only economy is fed Sweden's income process, also estimated and presented in Floden and Linde (2001).[28] All other parameters are exactly as in the US economy, except for ξ, which is set to a value for which the highest paid person in Sweden works twice as long as the lowest paid person. The table also reports the wealth distribution statistics for Sweden taken from Domeij and Klein (1998). As is evident, the wealth distribution for our "Swedish" economy is surprisingly close to the actual Swedish wealth distribution. In particular, the bottom 20 percent of the population, on aggregate, holds debt (as opposed to assets) in both the model economy as well as in the data. Indeed, the level of indebtedness in the Swedish data is actually higher than in our "Swedish" model.[29] This

[28] The AR1 coefficient on the persistent process is 0.8139 and the variance of the innovation to this process is 0.0326; the variance of the permanent shock is 0.0467 and the variance of the transitory shock is 0.0251.

[29] We should note that there are competing explanations for the large fraction of negative net-worth individuals in

limited exercise indicates that the "extreme" distributional implications of the US garnishment-only economy may reflect the much greater degree of income risk in the US compared to European economies. Also, if Sweden were to adopt US-style discharge laws, then, as shown in the final column, the bottom quintile will become net savers; the capital output ratio will rise; and the distribution of wealth would look less unequal.

[Insert Table 3 here]

4.2 Welfare

The welfare effects of eliminating bankruptcy protection are now presented. The first measure gives the flow consumption a person would give up to go from a regime in which there is bankruptcy to a regime in which bankruptcy is eliminated.[30] The second measure simply counts the fraction of people who would be in favor of eliminating bankruptcy. The latter measure provides insight into the degree of political support in favor of or against the institution of bankruptcy.

In both cases, it is assumed that the question is posed in an unanticipated manner *after* people have made their default decision but *before* they have chosen their new asset positions. This timing ensures that the contemplated switch in regime does not impose unanticipated profits or losses on the intermediary sector.[31]

The top panel of Table 4 reports the consumption equivalent measure from eliminating bankruptcy, taking into account the transition to the new steady state. Each cell gives the consumption flow averaged across the cell's households. Overall, there is a significant gain from eliminating bankruptcy – amounting to about 1.0 percent of consumption in perpetuity. The gain is not uniform: Indebted people gain more than others. This makes sense because borrowing is cheaper in the garnishment-only economy. The income level matters as well: those receiving the lowest persistent or transitory efficiency shocks gain the most and those receiving the highest shocks the least. This pattern reflects the fact that those in need of loans are the ones who gain most from the decrease in borrowing rates. For the permanent shock, the pattern of relative gain is reversed: those with the highest permanent shock gain more than those with the lowest permanent shock. The high permanent shock individuals own a large amount of assets and they prefer the garnishment because of the higher associated interest rate on savings.

[Insert Table 4 here]

Sweden. Domeij and Klein (2002) argue that it is the nature of the Swedish public pension system that accounts for Sweden's considerable wealth inequality despite Sweden having a relatively low earnings inequality.

[30] The consumption equivalent measure is computed as follows: Given policies $c(a,e,h), n(a,e,h)$, and $d(a,e,h)$ corresponding to a value function $V(a,e,h)$, the value of using policies $\tilde{c}(a,e,h) = (1+\Gamma)c(a,e,h)$, $n(a,e,h)$, and $d(a,e,h)$ forever is computed using policy iteration. This is done for 30 values of Γ between -0.9 and 2. To find the Γ for which $\tilde{V}(a,e,h;\Gamma)$ equals some level of utility W, a nonlinear equation solver (interpolating $\tilde{V}$ in the Γ dimension) is used.

[31] We start with the steady state bankruptcy distribution in period 0. Then, all households that file for bankruptcy are transitioned to 0 assets and given a garnishment flag. Next, households make their c, n and a' choices conditional on there being no bankruptcy option going forward.

The bottom panel of the table reports the fraction of people in each cell in favor of eliminating bankruptcy protection. About 10 percent of the population opposes it and, interestingly, they are drawn mostly from the ranks of indebted people with high persistent and transitory efficiency shocks. Why do these people oppose the elimination of discharge? Because they have high income which they expect to mean revert, their need to borrow is low, and because they are indebted, they are unlikely to have a high level of assets. For these individuals the main effect on welfare comes from the decline in real wages. The effect is small (because the decline in wages is small) but they oppose the change, nevertheless.

Although factor prices do not change very much from one steady state to the other, Table 5 indicates that the steady-state welfare gains are about 0.2 percentage point, or less, lower than those taking the transition into account. Also, ignoring the transition can give a misleading picture of the degree of political support for the elimination of bankruptcy. Without the added benefit of the higher consumption afforded by the de-accumulation of capital, support for elimination of discharge is much lower. Overall, only 67 percent of the population now favors eliminating discharge.

[Insert Table 5 here]

Garnishment increases the value of maintaining access to credit markets and allows for an expansion of credit. It is useful to understand exactly what this expansion allows in terms of consumption profiles. With this in mind, a large number of individuals were simulated who "start life" with $a = 0$, $h = 0$ and e drawn from the invariant distribution. Their consumption and asset holdings were recorded for the next 80 periods (years) under both the bankruptcy steady state and the garnishment steady state. The following two figures display average consumption and average asset holdings across the two regimes for each of the 80 periods.

Figure 3 shows that mean asset holdings rise more slowly in the garnishment-only economy, whereas they increase rapidly in the bankruptcy economy. In the latter, the high cost of loans forces individuals to accumulate assets in order to self-insure. In the garnishment economy, the need to accumulate precautionary savings is much less urgent, since the loan supply schedule is much more attractive. Mean consumption is higher in the garnishment economy because people are saving less. Mean consumption is higher for some time until the accumulated debt burden begins to lower consumption below that in the baseline economy.

[Insert Figure 3 here]

The effects of better consumption smoothing can be seen in Figure 4, which displays the coefficient of variation of consumption for each age. Observe that the coefficient of variation is initially lower in the garnishment-only economy but then exceeds that of the baseline economy. It is lower initially because of the superior consumption smoothing afforded by the generous loan supply schedules in the garnishment-only economy. But the other side of the same coin is the increased dispersion of asset holdings resulting from enhanced borrowing and lending. Higher wealth inequality eventually translates into higher consumption inequality.

[Insert Figure 4 here]

Finally, the optimal garnishment regime, if discharge were to be eliminated, is investigated. This exercise is motivated by the consideration that elimination of discharge is a large institutional change that, if it were to be instituted, would almost surely result in significant changes in garnishment law as well. The average steady-state consumption gains for a range of $c_{\min}$ and γ values were computed.[32] The optimal garnishment regime is one with $\gamma = 1$ and $c_{\min} = 0$. This is a "zero tolerance for delinquency" regime in which the creditors have the right to garnish *all* of the debtor's earnings in case of default. Eliminating discharge and instituting this garnishment regime raises average steady-state welfare by 3.71 percent as compared to 0.856 percent for the current garnishment regime. The optimal garnishment economy is essentially a "natural borrowing limit" (a la Aiyagari, 1994) economy with no default. There is no *voluntary* default because the creditors can garnish earnings fully to recover the defaulted debt so the defaulter does not gain current consumption but pays the reputation costs associated with a bad credit history. And there is no *involuntary* default because individuals never find it in their interest to borrow more than the amount that can be rolled over even in the event the debtor has the lowest efficiency level. For the baseline calibration, this natural borrowing limit is -1.58, or roughly 360 percent larger than average income in the economy. In contrast, the maximum amount that an individual would wish to borrow in the current garnishment regime (with no discharge) is -0.93, or roughly 210 percent larger than average income in the economy.[33]

This logic makes clear that the optimality of the "zero tolerance" regime hinges on the size of the lowest efficiency level.[34] If this level is very low – "a disaster state" – the optimal garnishment economy will not be the "zero tolerance" one. This point is verified by augmenting the income process with an efficiency level that corresponds to a super-poor state, which happens with a very small probability and is very transitory.[35] Addition of this state does not change model statistics in the baseline economy because the probability of the super-poor state is very low and the individual debtor always has the option to declare bankruptcy.[36] However, once bankruptcy protection is eliminated, the event looms large in the utility calculation of individuals. Basically, the presence of this state raises the welfare gain from elimination of discharge for low punishment regimes and lowers it for high punishment regimes. For instance, the welfare gain for the current regime rises from 0.841 percent to 0.917 percent and that for the "zero tolerance" regime declines from 3.710 percent

[32] We ignored the transition because it is time consuming to compute.

[33] The most that a lender would wish to borrow is the debt level at which $q(a', s)a'$ is maximized. Although the individual can borrow more than this, he would not want to because the borrower gets less in terms of current consumption and is saddled with more debt in the future.

[34] In the discretized income process of the baseline economy, the minimum efficiency level is a positive number although the true distribution allows for efficiency levels arbitrarily close to zero with vanishingly small probability.

[35] The efficiency level is 5 standard deviations below the unconditional mean of the log-efficiency process. It is iid and occurs with a probability of 1 in 3.5 million (which is the mass 5 standard deviations or more below the mean of a normal distribution).

[36] For example, both the population in debt and the population filing for bankruptcy are unchanged. The capital-output ratio declines slightly to 3.03 (from 3.07).

to 2.076 percent. Furthermore, the "zero tolerance " regime is no longer optimal; the optimal regime now has $\gamma = 0.50$ and $c_{\min} = 0$. These results are indicative of how the welfare results would change if wealth/liability shocks had been included in the model. As noted in Chatterjee et al. (2007) and in Livshits et al. (2007), wealth shocks stemming from uninsured medical expenses are an important trigger for bankruptcy. Including such shocks will likely reduce the welfare gain from elimination of discharge. In this sense, our welfare estimates should be viewed as an upper bound.

5 Conclusion

It is useful to conclude by putting the findings of this project into perspective and drawing some lessons regarding important future research lines in the area of consumer default.

A question one might ask is whether the findings reported in this paper *firmly* support the notion that the US economy would be better off without bankruptcy protection. Although a 1 percent increase in welfare is large by the standards of macroeconomic analysis, this gain must be set against costs ignored in this study. One cost that has been ignored is the cost of enforcing garnishment laws. In the baseline economy, less than 2 percent of the population suffer garnishment each period; in the counterfactual, close to 16 percent do. To process such a large volume of garnishments, the administrative and legal resources devoted to this task must be increased very substantially. Second, a society with as extreme a wealth distribution as the garnishment-only economy would presumably suffer from political and social costs. These missing costs suggest that the findings reported in this paper do not provide a convincing case for elimination of bankruptcy protection, at least given current garnishment laws.

This, then, raises the question of whether default policy should move in the direction of eliminating bankruptcy protection *and* toughening up garnishment laws. A strong commitment to honor one's debt works well if it is combined with forward-looking behavior that steers individuals away from truly bad financial situations. But the train of events of the last several years shows that individuals may not possess the requisite foresight to pull this off. After decades of low aggregate volatility, the Great Contraction caught people and policymakers by surprise. The design of legal institutions that can facilitate the optimal societal response to unexpected situations remains an open and important task. In this quest, historical experience can serve as a guide: In the pre-discharge era, state legislatures granted delinquent debtors one-time debt forgiveness when macroeconomic conditions were particularly bad. Estimating the net benefits of tough garnishment laws coupled with state-contingent bankruptcy protection would seem to be a useful line of research.

Another question one might ask is what lessons do quantitative-theoretic models offer for conventional empirical research on consumer default? Empirical studies (well-known examples are Fay, Hurst and White (2002) and Gross and Souleles (2002)) focus on testing the sign restrictions on regression coefficients implied by simple models of default. Quantitative-theoretic models go beyond simple default models in making predictions regarding the *magnitude* of the various effects as well. This added quantitative information can be useful in interpreting empirical findings, in terms of the importance of the various causal mechanisms at work. A case in point is the muted effect of variation in garnishment restrictions (all else remaining the same) on bankruptcy filing rates in the model. As noted earlier, this difference may arise from the presence of real world features missing in the model such as informal bankruptcy and the effects of state variations in Chapter 7 homestead exemptions. Furthermore, the fact that quantitative-theoretic models are fully articulated artificial economies composed of heterogeneous agents operating through time can be leveraged to generate artificial data of the type available to empirical researchers and which can then be approached in the same way that researchers approach real data. This procedure can illuminate the strengths and weaknesses of empirical specifications in uncovering causal links that researchers believe exist in reality – and which exist for sure in the model-generated data – but can get distorted, or masked, by data limitations (Chen, 2010).

Aside from enriching the interplay between theory and empirics, quantitative-theoretic models may alert empirical researchers to regularities that should exist in the data, if the underlying theory is correct. One example of this is the prediction that the costs of garnishment ought to be lower than the costs of bankruptcy and that debts collected in garnishment should be smaller, on average, than debts written off in bankruptcy. The feedback can also go the other way: Fay, Hurst and White's finding that many individuals forgo bankruptcy even when it is financially beneficial has motivated quantitative theorists to include the heterogeneous non-pecuniary costs of bankruptcy filings (Athreya, Tam and Young, 2009).

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A Extended Model Description

Let $A \subset R$ denote the set of asset positions. In the theory as well as in the computation, A is taken to be a finite set, which includes 0 and positive and negative elements. A^{--} is the set of strictly negative elements and A^{+} the set of non-negative elements. Denote the sequence of current and future factor prices by $\mathbf{p} = \{w_{t+j}, r_{t+j}\}_{j=0}^{\infty}$. Let $w(\mathbf{p})$ and $r(\mathbf{p})$ denote the current wage and rental rates, namely, w_t and r_t. Let B denote the shift operator $B(\mathbf{p}) = \{w'_{t+j}, r'_{t+j}\}_{j=0}^{\infty}$, where $w'_{t+j} = w_{t+1+j}, r'_j = r_{t+1+j}$, $j = 0, 1, 2, \ldots, \infty$.

In addition to the individual states a, e, and s, there is a state variable $h \in \{0, 1, 2\}$ that takes on the value 1 if the person has a record of a past bankruptcy filing; the value 2 if the person is currently under garnishment (i.e., has some unpaid debt obligation) or if the person has satisfied the garnishment but the record of the garnishment has not yet been removed from the person's credit history; the value 0 if there is no record of any filing or garnishment in the person's credit history. We will denote the optimal lifetime utility of a person in state (a, e, s, h) by $V(a, e, s, h; \mathbf{p})$. We index the value functions (and decision rules) by $\mathbf{p}$ to emphasize the fact that the value of these objects depends on the current and future trajectory of factor prices.

A.1 Decision Problem of People

A person can be in one of five situations:

1. $a < 0$ and $h = 0$. In this case, the person has three options: he can repay his debt; he can default on his debt and subject himself to garnishment; or he can file for bankruptcy. The value from repayment, which we denote as $V^R(a, e, s, h = 0, \mathbf{p})$, is given by the following dynamic program:

$$V^R(a < 0, e, s, h = 0; \mathbf{p}) = \max_{a' \in A, n \in [0,1], c \geq 0} u(c, n, e) + \beta \rho E_{(s', e')|s} V(a', e', s', h = 0; \mathbf{p}')$$

s.t.

$$c = w(\mathbf{p}) en + a - I_{\{a' < 0\}} q(a', s; \mathbf{p}) a' - I_{\{a' \geq 0\}} \bar{q}(\mathbf{p}) a'$$

$$\mathbf{p}' = B(\mathbf{p}),$$

where $I_{\{\cdot\}}$ denotes an indicator function that takes on the value 1 if the expression in $\{\cdot\}$ is true and 0 otherwise.

The value from default and garnishment, which we denote by $V^G(a, e, s, h; \mathbf{p})$, is given by the following dynamic program

$$
\begin{aligned}
&V^G(a<0,e,s,h=0;\mathbf{p}) = \\
&\max_{a'\in A, n\in[0,1], c\geq 0} u(c,n,e) + \beta\rho E_{(s',e')|s}[I_{\{a'<0\}}V^G(a',e',s',h=2;\mathbf{p}')+ \\
&\qquad\qquad\qquad\qquad\qquad I_{\{a'\geq 0\}}V(a',e',s',h=2;\mathbf{p}')] \\
&\text{s.t.} \\
&a'-a \geq \min\{\max\{0,\gamma(w(\mathbf{p})en - c_{\min})\}, -a\} \\
&c = w(\mathbf{p})en - [a'-a]I_{\{a'<0\}} - I_{\{a'\geq 0\}}[\bar{q}(\mathbf{p})a' - a] \\
&\mathbf{p}' = B(\mathbf{p}).
\end{aligned}
$$

The value from bankruptcy, which we denote by $V^B(a,e,s,h;\mathbf{p})$, is given by the following dynamic program:

$$
\begin{aligned}
&V^B(a<0,e,s,h=0;\mathbf{p}) = \max_{a'\in A, n\in[0,1], c\geq 0} u(c,n,e) + \beta\rho E_{(s',e')|s}V(0,e',s',h=1;\mathbf{p}')] \\
&\text{s.t.} \\
&c = w(\mathbf{p})en \\
&\mathbf{p}' = B(\mathbf{p}).
\end{aligned}
$$

The person chooses the best of these options. Therefore, in this case,

$$
\begin{aligned}
&V(a<0,e,s,h=0;\mathbf{p}) = \\
&\qquad \max\{V^R(a<0,e,s,h=0;\mathbf{p}), V^G(a<0,e,s,h=0;\mathbf{p}), V^B(a<0,e,s,h=0;\mathbf{p})\}
\end{aligned}
$$

2. $a<0$ and $h=2$. This is the case where the person defaulted in some previous period, hasn't paid off his obligations and is under garnishment. This person can exit garnishment by filing for bankruptcy or he can continue on in garnishment. The value from doing the former is given by

$$
\begin{aligned}
&V^B(a<0,e,s,h=2;\mathbf{p}) = \max_{a'\in A, n\in[0,1], c\geq 0} u(c,n,e) + \beta\rho E_{(s',e')|s}V(0,e',s',h=1;\mathbf{p}')] \\
&\text{s.t.} \\
&c = (1-\chi_g)w(\mathbf{p})en \\
&\mathbf{p}' = B(\mathbf{p}).
\end{aligned}
$$

The value of doing the latter is given by:

$$\begin{aligned}
&V^G(a<0,e,s,h=2,\mathbf{p}) = \\
&\max_{a'\in A, n\in[0,1], c\geq 0} u(c,n,e) + \beta\rho E_{(s',e')|s}[I_{\{a'<0\}}V^G(a',e',s',h=2;\mathbf{p}')+ \\
&\qquad\qquad I_{\{a'\geq 0\}}V(a',e',s',h=2;\mathbf{p}')] \\
&\text{s.t.} \\
&a'-a \geq \min\{\max\{0,\gamma(w(\mathbf{p})en-c_{\min})\},-a\} \\
&c = [1-\chi_g]w(\mathbf{p})en - [a'-a]I_{\{a'<0\}} - I_{\{a'\geq 0\}}[\bar{q}(\mathbf{p})a'-a] \\
&\mathbf{p}' = B(\mathbf{p}).
\end{aligned}$$

The person chooses the best option, so, in this case

$$V(a<0,e,s,h=2;\mathbf{p}) = \max\{V^G(a<0,e,s,h=2;\mathbf{p}), V^B(a<0,e,s,h=2;\mathbf{p})\}.$$

3. $a \geq 0$ and $h = 2$. This is the case where the person was in garnishment in the past but the garnishment flag has not yet been removed.

$$\begin{aligned}
&V(a\geq 0,e,s,h=2;\mathbf{p}) = \\
&\max_{a'\in A^+, n\in[0,1], c\geq 0} u(c,n,e) + \beta\rho E_{(s',e')|s}[(1-\lambda_g)V(a',e',s',h=2;\mathbf{p}')+ \\
&\qquad\qquad \lambda_g V(a',e',s',h=0;\mathbf{p}')] \\
&\text{s.t.} \\
&c = [1-\chi_g]w(\mathbf{p})en - \bar{q}(\mathbf{p})a' + a \\
&\mathbf{p}' = B(\mathbf{p}).
\end{aligned}$$

4. $a \geq 0$ and $h = 1$. This is the case where the person filed for bankruptcy in the past and the bankruptcy flag has not yet been removed.

$$\begin{aligned}
&V(a\geq 0,e,s,h=1;\mathbf{p}) = \\
&\max_{a'\in A^+, n\in[0,1], c\geq 0} u(c,n,e) + \beta\rho E_{(s',e')|s}[(1-\lambda_b)V(a',e',s',h=1;\mathbf{p}')+ \\
&\qquad\qquad \lambda_b V(a',e',s',h=0;\mathbf{p}')] \\
&\text{s.t.} \\
&c = [1-\chi_b]w(\mathbf{p})en - \bar{q}(\mathbf{p})a' + a \\
&\mathbf{p}' = B(\mathbf{p}).
\end{aligned}$$

5. $a \geq 0$, $h = 0$. In this case, the person has no outstanding obligations and no record of past

default.

$$
\begin{aligned}
&V(a \geq 0, e, s, h = 0; \mathbf{p}) = \max_{a' \in A, n \in [0,1], c \geq 0} u(c, n, e) + \beta \rho E_{(s', e')|s} V(a', e', s', h = 0; \mathbf{p}') \\
&\text{s.t.} \\
&c = w(\mathbf{p}) en + a - I_{\{a' < 0\}} q(a', s; \mathbf{p}) a' - I_{\{a' \geq 0\}} \bar{q}(\mathbf{p}) a' \\
&\mathbf{p}' = B(\mathbf{p}).
\end{aligned}
$$

The solution to this individual problem implies decision rules $a'(a, e, s, h; \mathbf{p})$, $n(a, e, s, h; \mathbf{p})$ and $c(a, e, s, h; \mathbf{p})$. In addition, for $a < 0$ and $h \in \{0, 2\}$ the solution also implies a bankruptcy decision rule $b(a, e, s, h; \mathbf{p})$ which takes the value of 1 if the person files for bankruptcy and zero otherwise, and a garnishment decision rule $g(a, e, s, h; p)$ that takes the value 1 if the person defaults (or continues in default) and subjects himself to garnishment, and 0 otherwise.

A.2 Decision Problem of the Representative Firm

The representative firm's optimization problem is static: it rents K and hires N each period to maximize current period profits. This decision problem is the same regardless of the legal regime in place.

$$
\max_{K \geq 0, N \geq 0} F(K, N) - w(\mathbf{p}) N - r(\mathbf{p}) K
$$

A.3 Decision Problem of the Intermediary Sector

As noted earlier, intermediaries are the counterparty to every borrowing and lending contract entered into by consumers and are also the owners of capital stock in this economy. We will assume that there is one representative intermediary who takes prices as given and chooses (i) how much capital to purchase in the current period (for use in the following period), (ii) how many new borrowing or lending contracts of different types to enter into with consumers, and (iii) if there is a market for defaulted debt, how much of each different types of defaulted debt to purchase.

The net return from the first activity (purchase of capital) is:

$$
-K' + \frac{(1 - \delta) + r(B(\mathbf{p}))}{1 + i(\mathbf{p})} K' \tag{4}
$$

Let $m'(y, s, \mathbf{p})$ be the measure of newly issued contracts of type $(y, s, \mathbf{p})$ held by the intermediary sector at the end of the current period. Let $\theta(y, s, \mathbf{p})$ be the fraction of borrowers who default (i.e., either file for bankruptcy or enter into garnishment) conditional on taking out a (new) loan of size y and having current persistent efficiency level s. And, conditional on there being a default, let $q^D(y, s, \mathbf{p})$ be the expected (per unit) value of the defaulted debt. We will refer to this as the *expected recovery rate.* Then, the net return from the second activity (purchase of newly issued loans or deposits) is:

$$\sum_{y\in A^+,e} m'(y,s,\mathbf{p})y\left[\bar{q}(\mathbf{p})-\frac{\rho}{1+i(\mathbf{p})}\right]+ \\ \sum_{y\in A^{--},e} m'(y,s,\mathbf{p})y\times\left(-q(y,s,\mathbf{p})+\frac{\rho}{1+i(\mathbf{p})}[(1-\theta(y,s;\mathbf{p})+\theta(y,s;\mathbf{p})q^D(y,s,\mathbf{p})\right). \tag{5}$$

Let $z'(y,s,\mathbf{p})$ be the measure of defaulted debt of type $(y<0,s,\mathbf{p})$ held by the intermediary sector. Let $\eta(\tilde{a},y,s';\mathbf{p})$ be the fraction of delinquent debtors who do not file for bankruptcy and choose $y\leq\tilde{a}$ next period, given an unpaid debt of y, a persistent efficiency level of s' and next period's aggregate state $B(\mathbf{p})$. Then, the net return from the third activity is:

$$\sum_{y\in A^{--},e} z'(y,s,\mathbf{p})y\times\Bigg(-x(y,s,\mathbf{p})+ \\ \frac{\rho}{1+i(\mathbf{p})}\sum_{s'}\sum_{\tilde{a}\in A}\eta(\tilde{a},y,s';B(\mathbf{p}))\left[(\min\{(\tilde{a}-y),-y\})/(-y)+I_{\{\tilde{a}<0\}}x(\tilde{a},s',B(\mathbf{p}))\right]\pi_{s'|s}\Bigg). \tag{6}$$

Let M' denote the distribution of newly issued contracts held by the intermediary sector and Z' the distribution of defaulted debt held by the intermediary sector.

The decision problem is to choose K',M',Z' to maximize the sum of (4), (5) and (6).

A.4 Equilibrium

We focus on perfect foresight equilibrium. Let $\mu(a,e,s,h)$ denote the distribution of people over the individual states. Let $\Gamma(\mu,\mathbf{p})$ describe the law of motion of this distribution. That is, $\mu'(a,e,s,h)=\Gamma(\mu(a,e,s,h),\mathbf{p})$ is the distribution of people of individual states next period, given the current distribution μ and current and future sequence of factor prices $\mathbf{p}$. The time evolution of the distribution is then given by the recursion $\mu^{t+1}(a,e,s,h)=\Gamma(\mu^t,B^t(\mathbf{p}))$, where it is understood that $\mu^0=\mu$, $B^0(\mathbf{p})=\mathbf{p}$ and $B^t(\mathbf{p})$ is defined by the recursion $B^t(\mathbf{p})=B(B^{t-1}(\mathbf{p}))$.

A perfect foresight competitive equilibrium for an initial distribution of people over individual states $\mu(a,e,s,h)$ and an initial aggregate capital K is (i) a sequence of current and future factor prices $\mathbf{p}$, (ii) a set of credit market prices $q(a<0,s,\mathbf{p})$, $\bar{q}(\mathbf{p})$, $x(y<0,s,\mathbf{p})$ and $i(\mathbf{p})$, (iii) a set of individual decision rules $a'(a,e,s,h;\mathbf{p})$, $n(a,e,s,h;\mathbf{p})$, $c(a,e,s,h;\mathbf{p}), b(a,e,s,h;\mathbf{p})$ and $g(a,e,s,h;\mathbf{p})$, (iv) a set of production sector decision rules $K(\mathbf{p})$ and $N(\mathbf{p})$, (v) a set of intermediary sector decision rules $K'(\mathbf{p})$, $m'(y,s,\mathbf{p})$ and $z'(y,s,\mathbf{p})$ and (vi) a law of motion $\Gamma(\mu,\mathbf{p})$ such that:

1. The decision rules solve the individual dynamic optimization problem, given $\mathbf{p}$ and credit market prices $q(y,s,\mathbf{p})$ and $\bar{q}(\mathbf{p})$.

2. $K(\mathbf{p})$ and $N(\mathbf{p})$ solve the production sector static optimization problem.

3. $K'(\mathbf{p})$, $m'(y,s,\mathbf{p})$ and $z'(y,s,\mathbf{p})$ solve the intermediary optimization problem.

4. The goods market clears:

$$F(K(\mathbf{p}),N(\mathbf{p})) = K'(\mathbf{p}) - (1-\delta)K + \sum_{a,e,s,h}\left[c(a,e,s,h;\mathbf{p}) + (I_{\{h=1\}}\chi_b + I_{\{h=2\}}\chi_g)w(\mathbf{p})en(a,e,s,h;\mathbf{p})\right]\mu(a,e,s,h). \tag{7}$$

5. The labor market clears:

$$N(\mathbf{p}) = \sum_{a,e,s,h} e\, n(a,e,s,h;\mathbf{p})\mu(a,e,s,h).$$

6. The market for physical capital clears:

$$K(\mathbf{p}) = K.$$

7. The credit market for newly issued debt clears:

$$\begin{aligned}&\forall\,(y,s)\in(A\times S)\\ &m'(y,s,\mathbf{p}) = \sum_{a,e} I_{\{a'(a,e,s,h=0;\mathbf{p})=y\}}\mu(a,e,s,h=0).\end{aligned} \tag{8}$$

8. The market for defaulted debt clears:

$$\begin{aligned}&\forall\,(y,s)\in(A^{--}\times S)\\ &z'(y,s,\mathbf{p}) = \sum_{h\in\{0,2\}}\sum_{a,e} I_{\{g(a,e,s,h;\mathbf{p})=1 \textit{ and } a'(a,e,s,h;\mathbf{p})=y\}}\mu(a,e,s,h).\end{aligned} \tag{9}$$

9. The probabilities $\theta(y,s,\mathbf{p})$ and $\eta(a',a,e,s;\mathbf{p})$ and the price $q^D(y,s,\mathbf{p}))$ that appear in the intermediary sector's decision problem must be consistent with individual decision rules and market prices. This requires:

$$\theta(y,s,\mathbf{p}) = \sum_{s',e'}\left[b(y,e',s',h=0;B(\mathbf{p})) + g(y,e',s',h=0;B(\mathbf{p}))\right]\phi_{s'}(e')\pi_{s'|s}, \tag{10}$$

$$\eta(\tilde{a},y,s';B(\mathbf{p})) = \sum_{e'} I_{\{b(y,e',s',h=2;B(\mathbf{p}))=0 \textit{ and } a'(y,e',s',h=2;B(\mathbf{p}))=\tilde{a}\}}\phi_{s'}(e'), \tag{11}$$

$$q^D(y,s,\mathbf{p}) = E_{(e',s')|s}\left\{\left[\frac{g(y,e',s',h=0;B(\mathbf{p}))}{\theta(y,s,\mathbf{p})}\right]\times \left[\frac{\min\{a'(y,e',s',h'=0;B(\mathbf{p}))-y,-y\}}{-y} + x(a'(y,e',s',h=0;B(\mathbf{p})),s',B(\mathbf{p}))\right]\right\} \tag{12}$$

In the expression for q^D, if for some y $g(y,e',s',h=0;B(\mathbf{p}))=0$ and $b(y,e',s',h=0;B(\mathbf{p}))=0$ for all (e',s'), the expectation term on the right-hand side becomes indeterminate (i.e., evaluates to $0/0$). In this case, the recovery rate in default is irrelevant and we set the expectation to 1.

10. The law of motion for μ is consistent with individual decision rules. This requirement is easiest to describe in three parts.

$$\begin{aligned}
&\Gamma(\mu,s)(\tilde{a},\tilde{e},\tilde{s},\tilde{h}=0)=(1-\rho)G(\tilde{a},\tilde{e},\tilde{s})\\
&\quad+\rho\sum_{a<0,e,s}I_{\{a'(a,e,s,h=0;\mathbf{p})=\tilde{a},\ b(a,e,s,h=0;\mathbf{p})=0,\ g(a,e,s,h=0;\mathbf{p})=0\}}\mu(a,e,s,h=0)\pi_{\tilde{s}|s}\phi_{\tilde{s}}(\tilde{e})\\
&\quad+\rho\sum_{a\geq 0,e,s}I_{\{a'(a,e,s,h=1;\mathbf{p})=\tilde{a}\}}\lambda_b\mu(a,e,s,h=1)\pi_{\tilde{s}|s}\phi_{\tilde{s}}(\tilde{e})\\
&\quad+\rho\sum_{a\geq 0,e,s}I_{\{a'(a,e,s,h=2;\mathbf{p})=\tilde{a}\}}\lambda_g\mu(a,e,s,h=2)\pi_{\tilde{s}|s}\phi_{\tilde{s}}(\tilde{e}),
\end{aligned}\tag{13}$$

$$\begin{aligned}
&\Gamma(\mu,s)(\tilde{a},\tilde{e},\tilde{s},\tilde{h}=1)=\\
&\quad\rho\sum_{a<0,e,s}I_{\{a'(a,e,s,h=1;\mathbf{p})=\tilde{a}\ and\ b(a,e,s,h=1;\mathbf{p})=1\}}\mu(a,e,s,h=0)\pi_{\tilde{s}|s}\phi_{\tilde{s}}(\tilde{e})\\
&+\rho\sum_{a<0,e,s}I_{\{a'(a,e,s,h=2;\mathbf{p})=\tilde{a}\ and\ b(a,e,s,h=0;\mathbf{p})=1\}}\mu(a,e,s,h=2)\pi_{\tilde{s}|s}\phi_{\tilde{s}}(\tilde{e})\\
&+\rho\sum_{a\geq 0,e,s}I_{\{a'(a,e,s,h=1;\mathbf{p})=\tilde{a}\}}(1-\lambda_b)\mu(a,e,s,h=1)\pi_{\tilde{s}|s}\phi_{\tilde{s}}(\tilde{e}),
\end{aligned}\tag{14}$$

$$\begin{aligned}
&\Gamma(\mu,s)(\tilde{a},\tilde{e},\tilde{s},\tilde{h}=2)=\\
&\quad\rho\sum_{a<0,e,s}I_{\{a'(a,e,s,h=1;\mathbf{p})=\tilde{a}\ and\ g(a,e,s,h=1;\mathbf{p})=1\}}\mu(a,e,s,h=0)\pi_{\tilde{s}|s}\phi_{\tilde{s}}(\tilde{e})\\
&+\rho\sum_{a\geq 0,e,s}I_{\{a'(a,e,s,h=1;\mathbf{p})=\tilde{a}\}}(1-\lambda_g)\mu(a,e,s,h=2)\pi_{\tilde{s}|s}\phi_{\tilde{s}}(\tilde{e}),
\end{aligned}\tag{15}$$

where G is the distribution over (a,e,s) from which newborns are drawn (all newborns start with $h=0$).

11. There is perfect foresight. That is, the sequence $\mathbf{p}$ is implied by the evolution of the economy starting from K and $\mu(a,e,s,h)$. Formally, this requires that for any $t\geq 1$ conditions (1)-(9) are satisfied for $K=K'^{t-1}(\mathbf{p}))$ and $\mu(a,e,s,h)=\mu^t(a,e,s,h)$, where μ^t satisfies the recursion $\mu^t(a,e,s,h)=\Gamma(\mu^{t-1},B^{t-1}(\mathbf{p}))$, with $\mu^0=\mu(a,e,s,h)$ and $B^0(\mathbf{p})=\mathbf{p}$.

The factor market clearing conditions and the two credit market clearing conditions impose restrictions on factor prices and on the price of loans and deposits which are used in computing the equilibrium of the model. If there is positive production in each period, then

$$r(\mathbf{p}) = F_K(K(\mathbf{p}), N(\mathbf{p})) \text{ and } w(\mathbf{p}) = F_N(K(\mathbf{p}), N(\mathbf{p})).$$

If the intermediary sector holds a positive quantity of capital each period, profit maximization requires that the net return from holding capital is exactly zero. From (4), this implies:

$$i(\mathbf{p}) = r(B(\mathbf{p})) - \delta.$$

If the intermediary sector holds positive amounts of deposits or loans of a given type, then the net return on the deposit or the loan must be zero. From (5) this implies that

$$\bar{q}(\mathbf{p}) = \frac{\rho}{1 + i(\mathbf{p})} \text{ and } \tag{16}$$

$$q(y, s, \mathbf{p}) = \frac{\rho}{1 + i(\mathbf{p})} \left[(1 - \theta(y, s; \mathbf{p}) + \theta(y, s; \mathbf{p}) q^D(y, s, \mathbf{p})\right]. \tag{17}$$

Finally, in the garnishment regime, if the intermediary sector holds positive amounts of defaulted debt then the net return on these debts must be zero as well. From (6), this implies:

$$x(y, s, \mathbf{p}) = \frac{\rho}{1 + i(\mathbf{p})} \times \sum_{s', \tilde{a} \in A} \eta(\tilde{a}, y, s'; B(\mathbf{p})) \left[(\min\{(\tilde{a} - y), -y\})/(-y) + I_{\{\tilde{a}<0\}} x(\tilde{a}, s', B(\mathbf{p}))\right] \pi_{s'|s}. \tag{18}$$

B Computation

The model is solved using a collection of mostly standard techniques. The persistent and permanent components of the efficiency process are discretized using the recent Rouwenhorst method introduced by Kopecky and Suen (2010). We use 3 permanent states and 5 persistent states. Conditional on having a permanent and persistent state, the probability of having a particular level of efficiency is calculated using Tauchen's (1986) method. The levels of efficiency (but not their probabilites) are chosen by discretizing the unconditional distribution using the Rouwenhorst method. We use 5 levels of efficiency (for a total of 75 states). The additional super-rich and/or super-poor state is added as discussed in the main text. The household problem is solved using a grid search accelerated with policy function iteration.

In making welfare comparisons, the presence of endogenous labor complicates obtaining the consumption equivalent measure. In particular, there is no analytic formula for it. Instead, we proceed in two steps. First, we obtain the welfare from having γ more consumption in every state of the world (holding fixed the other policies) using policy iteration (denote this utility $V(a, e, h; \gamma)$). Second, we compute the value of γ that equates $V(a, e, h; \gamma)$ with some comparison level of utility

W. This γ is the consumption equivalent measure. Given policies $c(a, e, h), n(a, e, h)$, and $d(a, e, h)$ corresponding to a value function $V(a, e, h)$, we construct a new consumption policy $\tilde{c}(a, e, h) = (1 + \gamma)c(a, e, h)$ and compute the value of using $\tilde{c}, n$, and d forever by using policy iteration. We compute this for 30 values of γ between -.9 and 2. Last, to find the γ for which $\tilde{V}(a, e, h; \gamma)$ equals some level of utility W, we use a nonlinear equation solver (interpolating $\tilde{V}$ in the γ dimension).

Table 1: Model Statistics and Parameter Values

Statistic	Target	Model	Parameter	Value
Targets determined independently				
Average years of life	40	40	ρ	0.975
Coefficient of risk aversion	2.0	2.0	σ	2.000
Capital share of income	0.36	0.36	α	0.360
Depreciation rate of capital	0.10	0.10	δ	0.100
Average years of exclusion following bankruptcy	10	10	λ_b	0.100
Average years of exclusion following garnishment	7	7	λ_g	0.143
Targets determined jointly				
Average hours worked	0.33	0.33	ζ	4.3×10^5
Earnings Gini index	0.61	0.46		
Wealth Gini index	0.80	0.83		
Percentage of filers	0.29	0.22	χ_b	0.01094
Percentage in debt	3.6	4.9	β	0.952
Capital-output ratio	3.08	3.07	$E_{\max}$	731.7
Debt-output ratio $\times$ 100	0.36	0.09		
Aggregate Collection Ratio	0.20	0.24	χ_g	0.00104
Other Statisitics				
Annual debt-weighted average interest rate		35.50		
Annual average interest rate		16.40		
Wealth share of the top 5 percent	57.8	65.6		
Wealth share of the 5th quintile	81.7	83.4		
Wealth share of the 4th quintile	12.2	10.6		
Wealth share of the 3rd quintile	5.0	4.4		
Wealth share of the 2nd quintile	1.3	1.4		
Wealth share of the 1st quintile	-0.2	0.1		
% of Population With Record of Bankruptcy		1.78		
% of Population With Record of Garnishment		3.50		
% of Population Defaulting into Garnishment		0.42		
% of Population in Garnishment with Debt	1.49	1.67		
Avg. Inc. in the Economy		0.44		
Avg. Inc. of Debtors Filing for Bankruptcy		0.16		
Avg. Inc. of Debtors Defaulting into Garnishment		0.13		
Fraction under Garnishment Filing Bankruptcy		.012		
Defaulted Debt as % of Total Debt	4.81	19.23		
Debts Discharged as % of Total Defaulted Debt		72		

Note: The table lists some US statistics with the corresponding statistics in the model, as well as the parameter values that most closely affect the model statistics. Where the US statistic is not known, its value is left blank. The parameters are as follows: ρ is a conditional probability of survival, σ is the coefficient of relative risk aversion, α is the capital share of income, δ is the depreciation rate of capital, λ_b and λ_g are the probabilities that a record of bankruptcy respectively garnishment is removed from an individual's credit history, χ_b and χ_g are the pecuniary costs of bankruptcy respectively garnishment, ζ is part of the disutility cost of labor, β is the time discount factor, and $E_{\max}$ is the efficiency of the super-rich households (the average efficiency in the economy is normalized to one).

Table 2: Comparison of Baseline and Garnishment-Only Economies

Statistic	Baseline	Garn. Only
Average hours worked	0.33	0.33
Earnings Gini index	0.46	0.46
Percentage in debt	4.89	29.69
Debt-output ratio as percentage	0.09	22.30
Percentage of defaulters	0.65	0.80
Percentage of people under garnishment with debt	1.67	16.31
Percentage of pop w/ impaired credit	5.28	18.27
Capital-output ratio	3.07	2.99
Wage per efficiency unit	1.20	1.18
Rental rate on capital (MPK - δ) in %	1.74	2.05
Annual debt-weighted average interest rate	35.50	21.60
Annual average interest rate	16.40	13.10
Wealth Gini index	0.83	1.00
Wealth share of the top 5 percent	65.6	76.0
Wealth share of the 5th quintile	83.4	94.3
Wealth share of the 4th quintile	10.6	10.0
Wealth share of the 3rd quintile	4.4	2.9
Wealth share of the 2nd quintile	1.4	-0.1
Wealth share of the 1st quintile	0.1	-7.0

Note: The table compares the baseline economy, where households can default by filing for bankruptcy or by entering into garnishment, to the garnishment-only economy where the option of filing for bankruptcy has been eliminated.

Table 3: Wealth Distribution for Sweden: Data and Model

Statistic	Data	Garn. Only	Garn. & Bank.
Wealth Gini Index	0.79	0.69	0.57
Wealth share of the top 5 %	33	26	23
Wealth share of the 5th quintile	72	65	58
Wealth share of the 4th quintile	25	25	24
Wealth share of the 3rd quintile	9	11	12
Wealth share of the 2nd quintile	1	3	5
Wealth share of the 1st quintile	-7	-5	1

Note: The table reports wealth statistics from Sweden's economy along with the comparable statistics for two different model economies. First is the model economy where households do not have an option to file for bankruptcy but may default by entering into garnishment. This framework is closest to Swedish law. Second is the model economy where households may default by entering into garnishment or by filing for bankruptcy.

Table 4: Welfare Gains From Elimination of Bankruptcy

Average Consumption Gain

	All	Permanent		Persistent		Transitory	
		H	L	H	L	H	L
All	1.1	1.4	0.8	0.5	5.8	0.3	3.8
In Debt	5.0	6.2	3.5	-0.0	10.2	0.1	8.8
No Debt	1.0	1.3	0.8	0.5	5.1	0.3	3.4

Population in Favor

	All	Permanent		Persistent		Transitory	
		H	L	H	L	H	L
All	89.8	98.9	81.2	92.5	100	95.9	99.9
In Debt	98.4	99.4	98.2	5.1	100	89.7	100
No Debt	89.6	98.9	80.9	92.8	100	96.0	99.9

Note: The table reports welfare gains from eliminating bankruptcy conditional on different samples of the population who have a good credit history taking into account the transition. The welfare gains are measured in two ways. The first measure is the "Average Consumption Gain." A "consumption gain" is the percentage increase in lifetime consumption needed to make a household indifferent between staying in the baseline economy with the consumption increase and moving to the garnishment-only economy. Averaging across a particular sample gives the average gain. The second measure is the "Population in Favor" which is the percentage of people (in a sample) who would benefit from eliminating bankruptcy. The different samples considered are combinations of indebted and non-indebted households with households having the highest "H" or lowest "L" permanent, persistent, or transitory income shocks.

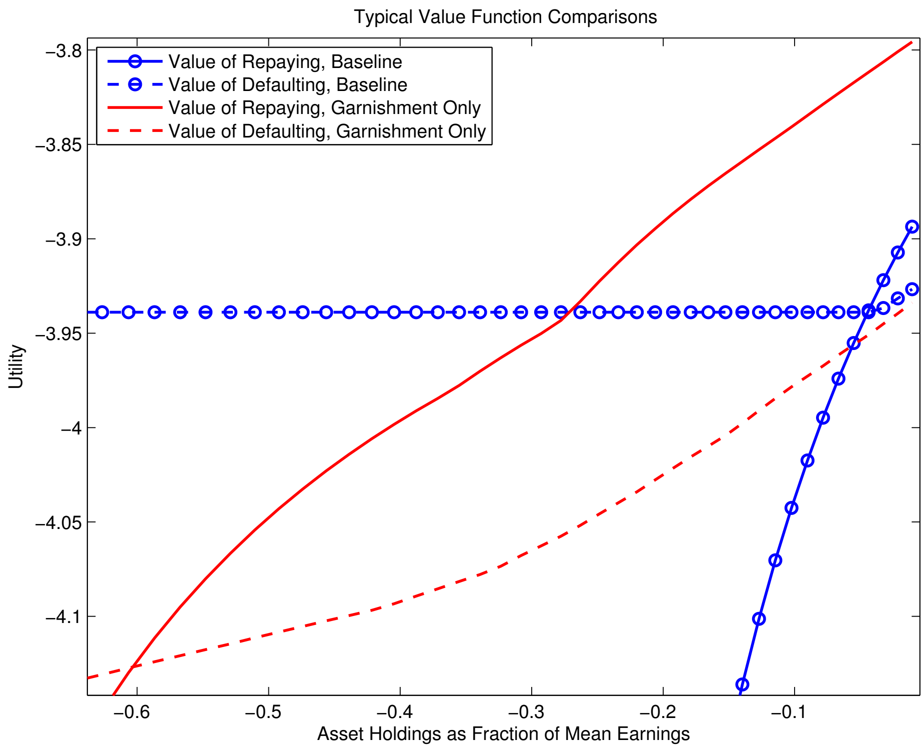
Table 5: Steady State Welfare Gains From Elimination of Bankruptcy

Average Consumption Gain							
	All	Permanent		Persistent		Transitory	
		H	L	H	L	H	L
All	0.9	1.2	0.6	0.3	5.5	0.2	3.5
In Debt	4.5	5.8	3.1	-0.4	9.7	-0.3	8.3
No Debt	0.8	1.0	0.6	0.3	4.8	0.2	3.1

Population in Favor							
	All	Permanent		Persistent		Transitory	
		H	L	H	L	H	L
All	67.4	80.4	62.9	67.0	100	50.5	99.6
In Debt	91.4	88.2	94.8	0.0	100	2.4	100
No Debt	66.7	80.2	62.3	67.2	100	51.1	99.6

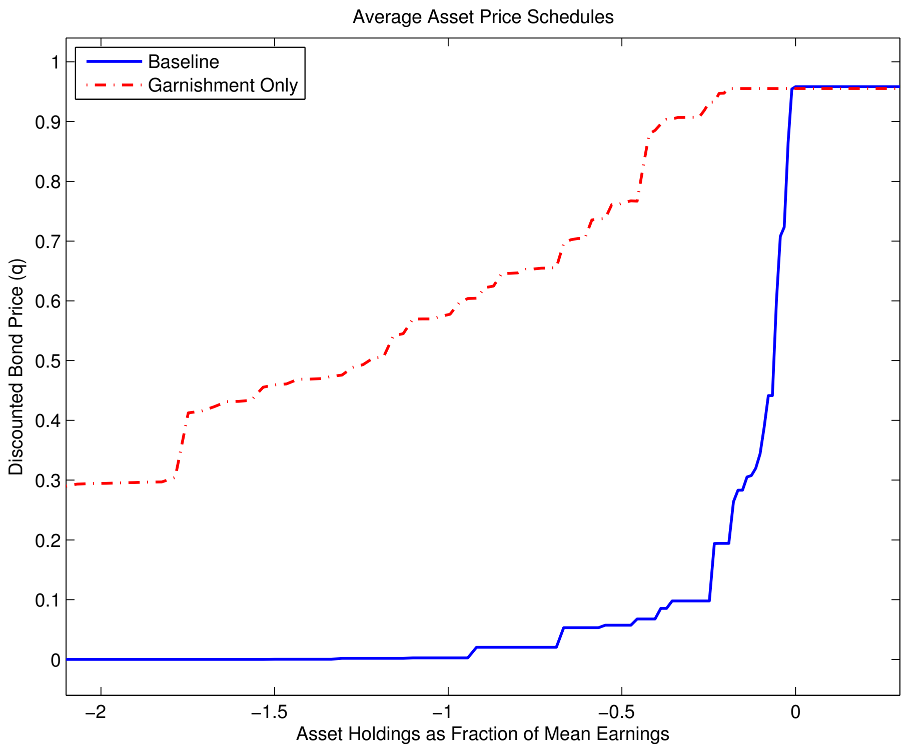
Note: The table reports welfare gains from eliminating bankruptcy conditional on different samples of the population who have a good credit history *without* taking into account the transition. The "Average Consumption Gain" measures how much households value eliminating bankruptcy. The "Population in Favor" measures how many households value it. "H" and "L" denote respectively the highest and lowest realized shock values.

Figure 1: Value Functions



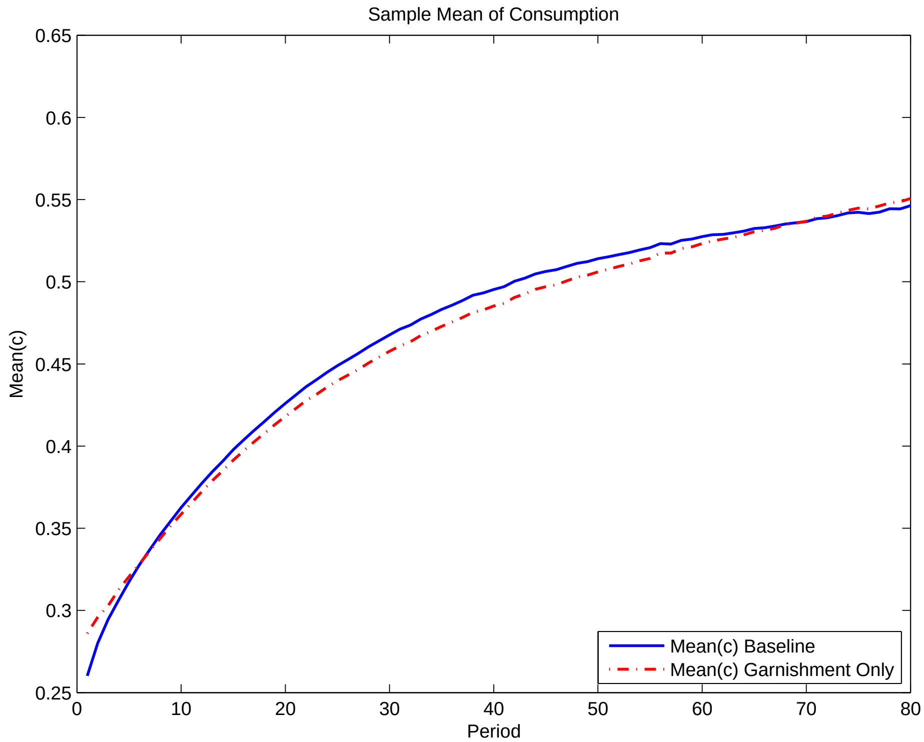
Note: The figure depicts typical value functions for two different choices in two different economies. In the baseline economy, households have the option to default using bankruptcy or garnishment. Hence their value of defaulting is the maximum of the value of declaring bankruptcy and the value of being garnished. This is labeled "Value of Defaulting, Baseline." Similarly, "Value of Repaying, Baseline" denotes the utility from not defaulting in the baseline economy. In the garnishment-only economy where the bankruptcy option has been eliminated, "Value of Defaulting, Garnishment Only" denotes the value of entering into garnishment and "Value of Repaying, Garnishment Only" denotes the value of not defaulting.

Figure 2: LOAN SUPPLY IN THE BASELINE AND GARNISHMENT-ONLY ECONOMIES



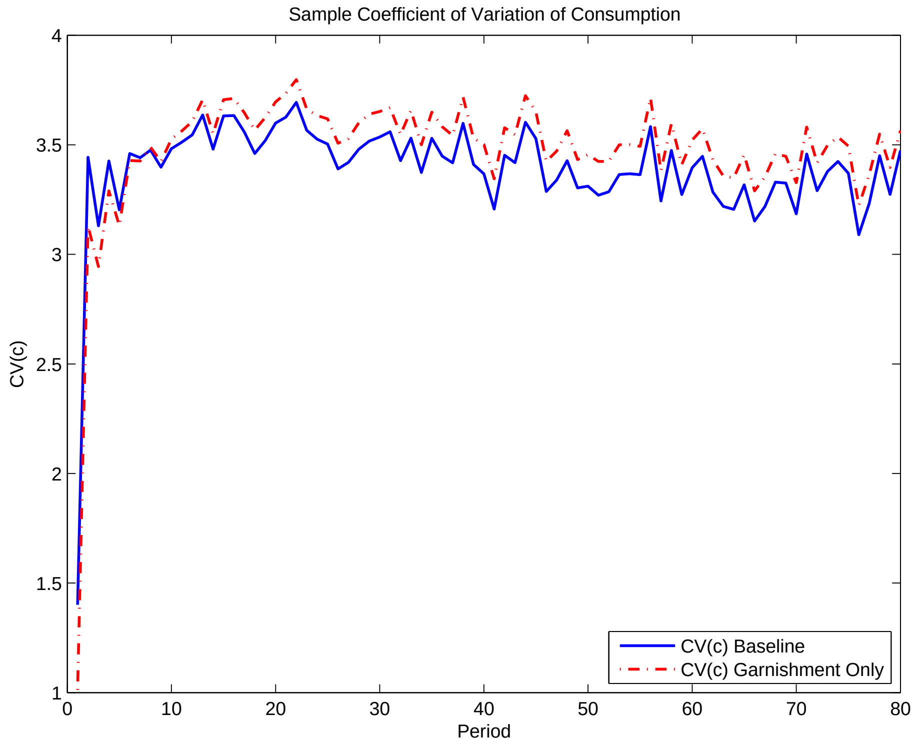
Note: The figure depicts the price schedules of the baseline and garnishment-only economies. The further up and to the left the discount-bond price schedule is, the cheaper credit is. "Average" price schedule here means the price schedule with the efficiency level integrated out (using the invariant distribution of efficiency).

Figure 3: Mean Consumption by "Age"



Note: The figure depicts the average level of consumption across a sample of 10 million households over 80 periods in the baseline and garnishment-only economies. Households are born (in period 1) with zero asset holdings with a good credit history and a random realization of income (drawn from the invariant distribution).

Figure 4: Dispersion of Consumption by “Age”



Note: The figure depicts the coefficient of variation of consumption across a sample of 10 million households over 80 periods in the baseline and garnishment-only economies. Households are born (in period 1) with zero asset holdings with a good credit history and a random realization of income (drawn from the invariant distribution). The coefficient of variation is the standard deviation divided by the mean and is a unit-free measure of dispersion.